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# Trajectories of Peer-Nominated Aggression: Risk Status, Predictors and Outcomes

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Developmental trajectories of peer-nominated aggression, risk factors at baseline, and outcomes were studied. Peer nominations of aggression were obtained annually from grades 1 to 3. Three developmental trajectories were identified: an early-onset/increasers trajectory with high levels of peer-nominated aggression at elementary school entry and increasing levels throughout follow-up; a moderate-persistent trajectory of aggression in which children were characterized by moderate levels of physical aggression at baseline; and a third trajectory with stable low levels of aggression. Children following the early-onset/increasers trajectory showed physical forms of aggression at baseline. Male gender and comorbid attention deficit/hyperactivity problems, oppositional defiant problems and poor prosocial behavior plus negative life events predicted which children would follow the early-onset/increasers trajectory of aggression. The outcomes associated with the early-onset/increaser children suggest high risk for chronically high levels of aggressive behavior.

**KEY WORDS:** developmental trajectories; conduct problems; peer nominations of aggression; risk factors.

Childhood aggressive behavior is a strong predictor of serious negative health and psychosocial outcomes. These outcomes include depression, conduct disorder, antisocial behavior, substance abuse, peer rejection, poor school performance, school dropout, and poor job performance (Caspi, Moffitt, Newman, & Silva, 1998; Deater-Deckard, 2001; Loeber, Green, Keenan, & Lahey, 1995; Moffitt, Caspi, Dickson, Silva, & Stanton, 1996; Moffitt, Caspi, Harrington, & Milne, 2002; Nagin & Tremblay, 1999). Despite the high stability of aggressive behavior from childhood into adolescence and young adulthood, many aggressive children will not persist in this behavior. Tremblay et al. (1999) reported for instance that 80% of all 17-month-old toddlers showed physically aggressive behavior, whereas in a cross-national study on the development of aggressive behavior, 4–11% of all children were found to follow a chronic physically aggres-

sive trajectory through adolescence (Broidy et al., 2003). The aim of this study is to expand on the recently published studies on developmental trajectories of aggression by examining trajectories of peer-nominated aggression in childhood, the predictors of following a particular trajectory, and the outcomes associated with a high-risk trajectory. To examine this question, information was required on (1) the various expressions of conduct problems in early elementary school, (2) the risk factors in childhood associated with a particular developmental trajectory, (3) the subsequent developmental trajectories of aggression, and (4) the developmental outcomes of these trajectories.

Several developmental theories have proposed distinct developmental trajectories toward the above mentioned poor outcomes (Loeber & Stouthamer-Loeber, 1998; Moffitt, 1993; Patterson, DeBaryshe, & Ramsey, 1989). These theories propose two mutually exclusive subgroups of antisocial children: children who show antisocial behavior early in life and who will follow a life course persistent antisocial trajectory vs. children who will engage in antisocial behavior only during adolescence. Loeber and Stouthamer-Loeber (1998) proposed a sub-classification of the early-onset/life-course type children: a preschool-onset type and a childhood-adolescent-onset

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type. There is empirical evidence to support the distinction between life-course persistent and adolescent-onset antisocial behavior (Fergusson & Horwood, 2002; Moffitt et al., 1996, 2002). However, results from some studies challenge the validity of the distinction, or at least the validity of generalizing the theory to more specific forms of antisocial behavior, for instance aggression. Several recently published studies identified trajectories of aggression from childhood into adolescence and, in accordance with the early-onset theory, identified a chronically high trajectory. However, a second early-onset trajectory with decreasing levels of aggression into adolescence (high-desister trajectory) was also identified (Nagin & Tremblay, 1999), whereas no adolescent-limited trajectory for aggression was found in a cross-national study (Broidy et al., 2003). In a critical comment, Silverthorn and Frick (1999) suggested that the distinction in age of onset in the development of antisocial behavior may apply for males, but may not accurately describe the development of antisocial behavior in females. Many risk factors associated with an early onset of antisocial behavior in boys are also found in the childhoods of girls who will develop antisocial behavior, but unlike boys, girls follow a 'delayed-onset' trajectory in which the development of antisocial behavior is delayed until adolescence. Fergusson and Horwood (2002) found only partial support for this theory and argued that most females who engaged in antisocial behavior are likely to follow an adolescent-onset trajectory, whereas only a small minority of these females will follow an early-onset trajectory.

In addition to studying the developmental course of aggression, research has focused on factors that explain why children follow particular developmental patterns of aggression. Both factors within the child, such as co-occurring problem behaviors, and factors within the family context, such as parenting or major life events, have been associated with specific developmental trajectories. For instance, Loeber and Stouthamer-Loeber (1998) argue that it is the presence or absence of comorbid ADHD that distinguishes between the preschool-onset type and a childhood-adolescent-onset type of antisocial behavior. According to the authors, ADHD is linked to a preschool onset type through its association with poor cognitive and academic capabilities, its involvement in the maintenance of oppositional behavior, and its activation of early and accelerated development of aggressive behaviors and conduct problems. Rutter, Giller, and Hagell (1998) suggested that both genetic and environmental components are involved with an early-onset path. In line with this, Moffitt and Caspi (2001) found that the early-onset trajectory is associated with neurocognitive problems, resulting in low IQ and poor school functioning, early behavioral prob-

lems, and temperamental problems. In addition to factors within the child, factors within the familial or contextual domain have also been related to an early-onset trajectory. Nagin and Tremblay (2001) reported that apart from co-occurring problem behaviors, the offspring of poorly educated, teenage mothers or who experienced a family breakup to be at risk for following a chronically high-physical-aggression trajectory from childhood into adolescence. The authors speculated that 'adolescent mothers with low-educational attainment tend to lack the skills needed to create a context in which children learn to regulate physical aggression' (p. 393), thus suggesting that factors within the family context may also explain why these children follow a chronically high-aggression trajectory. In line with this, Moffitt and Caspi (2001) found that inadequate parenting predicted that children would follow the life-course persistent trajectory and Shaw, Gilliom, Ingoldsby, and Nagin (2003) reported that rejecting parenting and maternal depression increased the risk that children would follow a chronically high overt antisocial trajectory from age 2 to 8. A late onset or adolescent-limited path appears to be associated with environmental factors, largely through affiliation with deviant peers (Patterson & Yoerger, 1997).

Aggressive children display various forms of aggressive behavior. The criteria for DSM-IV Conduct Disorder (American Psychiatric Association, 1994), for instance, include behaviors reflecting physical aggression, destructive aggression, deceitfulness or theft, and serious violations of rules. Loeber et al. (1993) argue for a distinction between overt (physical aggression) and covert aggression (covert antisocial acts, truancy) and authority conflict (stubborn behavior, deviance). Nagin and Tremblay (1999) examined developmental trajectories of disruptive behavior and found that physical aggression best predicted serious delinquency in adolescence and Loeber et al. (1995) reported that physical aggression in young children best predicted Conduct Disorder in adolescence. To further our understanding of the development of aggressive behavior across childhood and to provide a firm base for prevention, we examined, in addition to predictor variables, what the characteristic forms of conduct problems are, among children following different developmental trajectories of aggression.

Despite the advances from studies that have employed trajectory analyses, some comments are noteworthy. The first regards the informants used. Studies on developmental trajectories of aggression that started in childhood have generally used teacher, parent, or self reports (Broidy et al., 2003; Fergusson & Horwood, 2002; Nagin & Tremblay, 1999; Schaeffer, Petras, Ialongo, Poduska, & Kellam, 2003). Trajectories based on peer nominations of

aggression have, to our knowledge, not yet been studied. Peer nominations of aggression have a number of advantages. First, they are based on multiple informants and are therefore very reliable (Coie, Dodge, & Kupersmidt, 1990; Crick & Grotpeter, 1995). Second, they report about aggressive acts outside the presence of adults. Third, they reflect the social context in which children function (Patterson, Reid, & Dishion, 1992). It may well be the influence of the child's broader social context, which refers to the interaction with classmates and peers that plays a crucial role in the emergence, the manifestation, and the maintenance of aggressive behavior (Coie & Jacobs, 1993). Coie, Dodge, Terry, and Wright (1991) showed that peers reinforce the aggressive child's acts of coercion, physical force and threats by backing down and allowing them to succeed. As a result, aggressive children believe that aggression has positive consequences, leading to a prolongation of aggressive and coercive behavior. Nonaggressive peers, on the other hand, become increasingly mistrustful of aggressive children and reject the aggressive child (Newcomb, Bukowski, & Pattee, 1993). The aggressive and disliked child is left with few social settings that provide correction for his behavior and ultimately drifts toward similarly deviant peers. These children are at high risk for externalizing and antisocial behavior and extreme forms of delinquency in adolescence (Deater-Deckard, 2001; Warman & Cohen, 2000). The use of peer nominations of aggression to construct developmental trajectories has therefore the advantage that a reliable assessment of children's aggressive behavior is combined with the reflection of the social environment on the child's aggressive behavior.

The second comment on recently published studies about developmental trajectories regards limitations of the methodology used. First, the semi-parametric group-based modeling approach (Nagin & Tremblay, 1999; Nagin, 1999) used in many of these studies assumes equal variability in problematic behavior between identified classes. These assumptions are likely not to be valid for highly variable behaviors such as aggression, in which, for instance more variability in classes with high-risk children than in classes with low-risk children is anticipated (Muthén, 2000, 2004). Second, with the exception of the study by Schaeffer et al. (2003), none of the studies have examined the association between predictors of class-membership, the trajectories, and the outcomes simultaneously. As a result, the associations may well be over- or underestimated in the reported studies.

The present study focuses on the development of aggression in childhood only. The following questions were addressed: (1) how many and which developmental trajectories are identified in peer-nominated aggression

over a 2-year period and (2) what are the characteristic conduct problems for children in each of these trajectories at baseline? In line with theories on developmental trajectories, we expect to identify at least two trajectories: an early-onset trajectory and a normative low-aggression trajectory. We also hypothesize that especially physical aggression will characterize children following an early-onset trajectory. (3) What is the gender distribution in the identified trajectories? We hypothesize that mainly boys will follow the early-onset trajectory. (4) Which risk factors within the child and family context are predictive of children following particular developmental trajectories of aggression? We hypothesize that the early-onset developmental trajectory of aggression is associated with attention deficit/hyperactivity (ADH) problems, oppositional defiant problems, and poor school functioning. (5) What are the outcomes in terms of externalizing problem behavior, school functioning, and sociometric status for children following different developmental trajectories? We hypothesize that children who follow an early-onset trajectory will perform especially poorly on each of these outcomes.

## METHOD

### Sample

Analyses were performed on a control group of children from a school based, preventive intervention study targeting disruptive behavior in young children in The Netherlands (Van Lier, Verhulst, van der Ende, & Crijnen, 2003). Large elementary schools in the Metropolitan area of Rotterdam and intercity of Amsterdam, The Netherlands were eligible for inclusion. The first 13 schools that responded positively to the invitation to cooperate with the project were included.

All 722 1st grade children in 1999, who moved on to 2nd grade over the summer were eligible for inclusion. Parents of 645 children (89.3%) signed a written informed consent granting their child's participation in the study. Sixty-nine percent of the children were Caucasian with 51% male, which was similar for participating and non-participating children (gender:  $\chi^2 = .02$ ,  $df = 1$ ,  $p > .05$ ; Caucasian:  $\chi^2 = 2.4$ ,  $df = 1$ ,  $p > .05$ ). Thirty-six percent of all children were of low SES.

Within each school, classes were randomly allocated to the intervention or control condition. Of the 722 children, 304 (47%) became control-group children. During the 2-year intervention period (2nd and 3rd grade), 17 children moved from a control-class to an intervention-class. These 17 children were excluded from the current study, making the sample 287 children.

### Sample Attrition

Forty-six children were lost to follow-up because they left school or due to grade retention. Loss to follow-up was not related to child's gender or teacher ratings of conduct problems. Peer-nominated aggression scores at baseline were higher for children who were lost to follow-up ( $F(1, 286) = 6.454, p < .05$ ). Mean age of the children was 6.9 years ( $SD = 0.6$ ) at baseline.

### Procedure

Teacher assessments were conducted in 1st grade (spring, 1999) and 3rd grade (spring, 2001). Five forms with preprinted names were sent to the teacher each week and they were asked to fill out the forms during that week. Teachers completed the teacher's report form (TRF) for each child in their class in approximately 5 weeks. Teachers received a gift certificate of about €50.

Peer nominations were conducted annually by two trained research assistants starting in 1st grade. Children completed the peer nomination forms in groups of six in a separate place in the school, supervised by the research assistants. The children were separated to ensure that they would not influence peers while filling out the forms. The children were asked whether they understood the description and, if necessary, an example was given. All children in the study completed the peer nomination forms at baseline and at the two follow-up assessments. Since, in general, children remain in their original class during elementary school (except for grade retention or moving away), the peer-group was relatively stable.

### Repeatedly Assessed Measure of Aggressive/Disruptive and Negative Behavior with Peers

*Peer nominations of aggressive and negative behavior with peers* were obtained through four behavioral descriptions in the spring of 1st, 2nd, and 3rd grade. Children were asked to nominate all classmates of either sex who fit each of the four descriptions: 'starts fights,' 'angers easily,' 'says mean thing to peers,' and 'is disruptive' (Coie & Dodge, 1988). The four scores were divided by the number of children in the class minus one (nominating yourself was not allowed) and then summed to a total score. Cronbach's alpha ranged from .92 to .94 over the three assessments. Confirmatory factor analyses revealed that in all three assessments, the item 'start fights' was the core item of this scale, with the other items having a high loading (all  $\geq .67$ ). For this reason, the scale measuring

peer nominations of aggressive and negative behavior will be named peer nominations of aggressive behavior for the remainder of this paper.

### Predictor Variables: Teacher Ratings

*Children's problem behaviors* over the last 2 months were assessed with the TRF/6–18 (Achenbach, 1991). The 1st grade spring assessment was used. Teachers rate the child's behavior on a 3-point scale (0 = not true, 1 = somewhat true, 2 = very true or often true). The TRF contains eight syndrome scales, two broad band scales Externalizing and Internalizing, and a total problem scale. In addition to the syndrome scales, six DSM-IV oriented scales are available (Achenbach & Rescorla, 2001). In the present study, ADH problems (13 items, which include 'Can't concentrate, can't pay attention for long,' 'Impulsive or acts without thinking' and 'Can't sit still'), oppositional defiant problems (ODD problems; 4 items, which include 'Argues a lot' and 'Disobedient at school') were used as behavioral predictors for developing along a particular risk trajectory. The Conduct Problems scale (12 items, which include 'Cruelty, bullying, or meanness to others,' 'Gets in many fights', 'Physically attacks people', and 'Steals') was used for the symptom endorsement profiles. The TRF has been translated and validated for use in The Netherlands (Verhulst, Van der Ende, & Koot, 1997).

### Predictor Variables: Peer Ratings

*Peer nominations of prosocial behavior* were obtained in the spring of 1st grade with the behavioral descriptions 'Is helpful' and 'Is a leader' (Coie & Dodge, 1988). The same procedure as used for peer nominations of aggressive behavior was employed. Cronbach's  $\alpha$  was .80.

### Predictor Variables: Parent Ratings

All parent ratings were assessed in the spring/summer of 1st grade through a home interview by trained interviewers.

*Parenting practices* were assessed with the global report form of the Alabama Parenting Questionnaire (APQ; Shelton, Frick, & Wootton, 1996). The APQ is a 42-item questionnaire in which parents rate on a 5-point Likert scale how often they display the described parenting behavior. The four parenting domains are Involvement (Cronbach's  $\alpha = .73$ ), Poor Monitoring/Supervision

( $\alpha = .73$ ), Inconsistent Discipline ( $\alpha = .56$ ), and Corporal Punishment ( $\alpha = .54$ ). High scores represent better parenting for the Involvement scale and poorer scores for the other three scales. The APQ has shown to differentiate families of children with disruptive disorder from families of normal children (Shelton et al., 1996). Poor parenting practices were defined as a score in the lower quartile for Involvement and upper quartile for Poor Monitoring, Inconsistent Discipline, and Corporal Punishment of the respective sample distributions.

*Parental stress around parenting* was obtained through the Nijmegen Parenting Stress Index (NPSI), which is the Dutch version of Abidin's Parenting Stress Index (Abidin, 1983) measuring the level of parental stress originating from several child and parent characteristics within the caregiver context (De Brock, Vermulst, Gerris, & Abidin, 1992). The items are scored on a 6-point Likert scale, ranging from completely agree to completely disagree. The short, 25-item form was applied. The NPSI discriminates between parents of referred and nonreferred children (De Brock, Vermulst, & Gerris, 1990). For the present article, scores in the upper quartile on the sum of the 14 items assessing parental stress originating from the child's behavior or temperament (De Brock et al., 1992) were included in the analysis. Cronbach's  $\alpha$  was .88.

*Parental psychopathology* was assessed with the Dutch translation of the General Health Questionnaire-28 item version (GHQ-28; Goldberg, 1972; Koeter & Ormel, 1991). The GHQ-28 consists of four 7-item scales measuring Somatic Symptoms, Anxiety/Insomnia, Social Dysfunction and Severe Depression in which the parents rate their mental health over the last 2 weeks on a 4-point Likert scale. Following the procedure suggested by Goldberg and Williams (1988) for scoring the 28-items GHQ, the scoring was transformed into a yes/no format by re-coding 0 (better than usual) and 1 (same as usual) into 0 (no) and 2 (worse than usual) or 3 (much worse than usual) into 1 (yes). Then all items were summed to a total score. High parental psychopathology was defined as having a total score of 5 or higher (Koeter & Ormel, 1991). The GHQ-28 has demonstrated adequate psychometric properties for use in The Netherlands (Koeter & Ormel, 1991).

*Socioeconomic status* was scored on the basis of the highest current parental occupation and highest level of education completed. Socioeconomic status was coded as 1 = low, 2 = intermediate and 3 = high socioeconomic (Netherlands Central Bureau of Statistics, 1993).

*Life events* were rated on the Life Events Questionnaire (Berden, 1992). Parents filled out a questionnaire containing 10 stressful life events. All 10 items state or imply a negative event in the direct context of the child, such as family breakup, a new partner in the family, severe

illness, death of a parent, or conviction to jail of a parent. The items had a yes/no format to indicate whether or not an event had occurred during the last 5 years. Item scores were summed to a total life event score. High-life events were defined as having two or more life events in the last 5 years.

*Male gender* was included as a predictor variable.

## Outcomes

*Teacher rated problem behavior* in 3rd grade was indicated by sum-scores and percentages of children in the borderline range or above the clinical cutoff on the TRF/6–18 Externalizing scale of the 3rd grade (spring) assessment.

*Peer Rejection* was assessed annually and based on a combination of liked-most and liked-least nominations. Children were asked to nominate the three children in their class who fit these two descriptions best. Liked-most and liked-least scores were standardized within the classroom and standardized social preference scores were computed by subtracting the liked-most  $z$ -score from the liked-least  $z$ -score. This social preference score was then standardized within the classroom. 'Rejected' children had social preference scores less than  $-1.0 SD$ , standardized liked-most scores less than zero, and standardized liked-least scores greater than zero (Coie & Kupersmidt, 1983). All remaining children were 'not rejected.' The one-year stability of rejection was .53 ( $p < .01$ , two-tailed). To explore peer-rejected sociometric status, stable rejected and ever-rejected children were identified. Stable rejected was defined as being rejected on all three assessments, or, if lost to follow-up, being rejected at the first two assessments and lost to follow-up at outcome. Ever rejected was defined as rejected at least on one assessment.

*Poor academic functioning* in 3rd grade was based on the teacher's rating of 'sometimes true' or 'very or often true' on the item 'Poor school work' of the TRF. Test-retest reliability was .79 ( $p < .01$ , 2 tailed).

## Statistical Approach

Developmental trajectories were analyzed using growth mixture modeling (GMM; Muthén, 2001; Muthén & Muthén, 2000a; Muthén & Shedden, 1999). The objective of GMM is to find the smallest number of classes of individuals with similar developmental trajectories of aggressive behavior. The GMM estimates mean growth curves, i.e., initial status (intercept) and change (slope), for each class of children and captures individual variation

around these growth curves by the estimation of factor variances for each class.

To identify classes of children with different symptom endorsement profiles of conduct problems at baseline, latent class analysis (LCA; McCutcheon, 1987) was used. The LCA describes the probabilities of a set of observed categorical variables across groups of individuals when group membership of the individuals is unknown.

Growth mixture models can be incorporated into a more general framework, general growth mixture modeling (GGMM; Muthén & Muthén, 2000a), allowing for combinations of models. In this framework, developmental trajectories (GMM) and distinct patterns of conduct problems (LCA) can be estimated simultaneously to identify patterns of young children's conduct problems at baseline that precede subsequent developmental trajectories of aggression.

For the LCA on items of teacher rated conduct problems, the following procedure was used. TRF/6–18 items reflecting similar content as DSM-IV criteria for conduct disorder (American Psychiatric Association, 1994) were used in the analysis (Achenbach et al., 2001). Items were dichotomized where 0 = not true and 1 = somewhat/sometimes or very true or often true.

The number of developmental trajectories of peer-nominated aggression was identified through GMM. Then the GMM was combined with the LCA into one GGMM. Finally, the predictor variables and outcomes were included in the GGMM. The estimated parameters of the final GGMM are: (1) latent class membership probabilities, which gives the probability of each individual belonging to each of the classes, (2) class-specific symptom endorsement profiles, which gives the probabilities that individuals in a class are described by conduct problem items, (3) means and variances of the growth factors (intercept and slope) for each of the classes, (4) the (multinomial) regression coefficient (odds ratio), predicting children's class membership by each of the predictor variables, and (5) the probability that individuals in a particular class will have the negative outcomes endorsed.

The overall GGMM and separate LCA and GMM were analyzed with Mplus 2.14 (Muthén & Muthén, 2000b). The Mplus missing data module was used to optimally use the data available and to take into account those children who were lost to follow-up had a different level of initial peer-nominated aggression than children who remained in the study.

Three different indications may be used in deciding on the optimal number of classes (Muthén & Muthén, 2000b). The first is the Bayesian Information Criterion (BIC; Kass & Raftery, 1993; Schwartz, 1978) in which lower BIC values indicate improvement of the model when

**Table I.** Frequency of Occurrence of TRF/6–18 Conduct Problem Items

TRF item	%
26. Does not seem to feel guilty after misbehaving (NoGuilt)	18
57. Physically attacks people (Attacks)	15
37. Gets in many fights (Fight)	14
16. Cruelty, bullying or meanness to people (Mean)	14
43. Lying or cheating (LieCheat)	13
39. Hangs around with others who get in trouble (BadComp)	8
90. Swearing or obscene language (Swears)	6
97. Threatens people (Threat)	4
101. Truancy or unexplained absence (Truant)	3
82. Steals (Steals)	2
21. Destroys property belonging to others (DestOthr)	2
73. Behaves irresponsibly (Irrespons)	2

*Note.* Names in parenthesis are abbreviations used in Fig. 1 (top).

compared to the model with one class less. The second is the classification quality of the model in which high average posterior probabilities indicate that the model is able to classify each child to one particular class. The third is the usefulness of the classes, which can be determined by comparing development trajectories, number of children in each class and differences in outcomes between classes.

## RESULTS

Classrooms contained an equal number of boys and girls ( $\chi^2 = 10.2$ ,  $df = 14$ ,  $p > .05$ ). Frequency of occurrence of 'somewhat/sometimes' or 'very true or often true' for TRF/6–18 conduct problems is displayed in Table I. The mean Conduct Problem score differed between classrooms ( $F(14, 272) = 6.118$ ,  $p < .01$ ). The correlation between 1st grade and 3rd grade teacher rated Externalizing behavior was .60 ( $p < .01$ , 2 tailed). Mean peer-nominated aggression scores was .73 [range: .45–1.03;  $F(14, 272) = 1.802$ ,  $p < .05$ ] at baseline, .83 [range: .54–1.36;  $F(14, 255) = 1.692$ ,  $p = .057$ ] at 1-year follow-up and .64 [range: .42–1.03;  $F(14, 226) = 1.303$ ,  $p > .05$ ] at outcome. The correlations between the repeatedly assessed peer-nominated aggression scores ranged from .73 to .83 ( $p < .01$ , two-tailed). The correlation between teacher rated conduct problems and peer-nominated aggression ranged from .48 to .60 ( $p < .01$ , two-tailed).

Following the procedure described by Muthén and Muthén (2000b) to find the optimal number of developmental trajectories, the variances of the continuous growth factors and the covariance between the growth factors were initially held equal to zero. To test our hypotheses, we first fitted a two-trajectory class (early-onset trajectory and low-aggressive trajectory) model. To test whether

additional trajectories were needed to describe the observed data, a three-class and four-class model were fitted. The two-class model (BIC 1383) was rejected over the three- (BIC 1197) and four- (BIC 1177) class model. Fitting more than four trajectory classes resulted in non-converging solutions. Allowing for random variation of the growth factors in the four-class model resulted in a nonconverged solution, through this improved the fit of the three-class solution (BIC 1124). It was therefore concluded that the additional fourth trajectory class was accounted for by the random variation in the growth factors in the three-class model and the model with three developmental trajectories was chosen as best fitting the data.

Starting values generated in the separate analyses were used in the GGMM. The predictor variables (child and parenting/contextual domain) and the outcome variables (Externalizing, rejection, and poor academic functioning at 3rd grade) were added. Likelihood ratio chi-square testing indicated that the variance for the growth factors and indicators (observed peer-nominated aggression) was different for the low-risk class ( $\chi^2 = 210$ ,  $df = 4$ ,  $p < .01$ ). The average class-membership probability for the final model was 1.0 for children in class 1, .98 for children in class 2, and .97 for children in class 3 indicating that the final model classified all children into one of the classes with very high precision. To study whether loss to follow-up had an impact on the model estimation, the final model was run only for children with complete data. The parameter estimates and percentage of children classified into each of the trajectory classes, the association with the predictor variables, and the outcomes predicted by the trajectories were similar to the model that included all children. The model including all children was therefore used for the remainder of the analyses.

### Developmental Trajectories of Aggression

The developmental trajectories of peer-nominated aggression are shown in Fig. 1 (top). Nine percent of all children were classified in class 1 (Table II) and 74% were boys. In 1st grade, class 1 children were nominated by each of their peers on average for 1.8 out of 4 aggressive roles. In 3rd grade, this increased to 2.4 out of 4 aggressive roles. High levels of peer-nominated aggression in 1st grade and an increase in the level of aggression as they grew older therefore characterized class 1 children. The developmental trajectory of class 1 children was best characterized as an early-onset/increasers trajectory.

Forty-three percent of all children were classified to class 2 and 70% of them were boys. Class 2 children were nominated for approximately 1.0 of the 4 aggressive roles

throughout the follow-up period. Moderate but persistent levels best characterized their developmental trajectory of peer-nominated aggression.

The remaining 48% of children were classified in class 3. These children were nominated on average 0.3 times in 1st grade and this level decreased slightly throughout the follow-up period. These children therefore follow a low-aggressive trajectory.

### Trajectories and Conduct Problem Endorsement Profiles

The conduct problem symptom endorsement profiles for the three classes are in Fig. 1 (bottom). Children who followed an early-onset/increasers class 1 developmental trajectory had on average 5.9 out of 12 Conduct Problem items endorsed by their 1st grade teacher (Table II). These children were marked by physical forms of conduct problems, especially '*Cruelty, bullying, or meanness to others*,' '*Physically attacks people*' and '*Gets in many fights*.' The probabilities for having these items endorsed were at or above .86, which indicates that almost all of the children in this class showed these forms of conduct problems at baseline. Children in class 1 had intermediate (*lying or cheating, swears*) and low (*truancy or unexplained absence*) probabilities for items reflecting more covert forms of conduct problems.

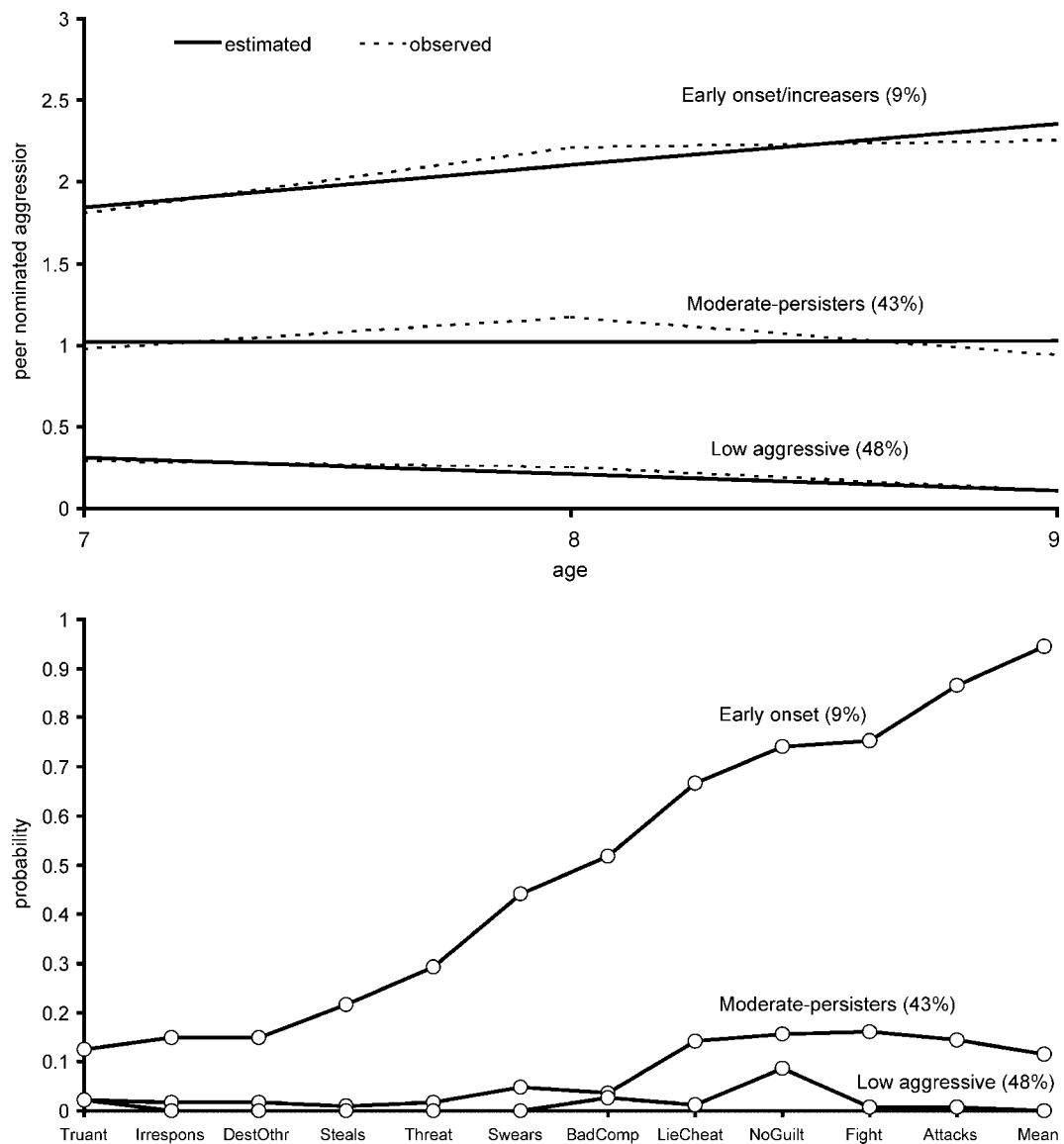
Children following the moderate-persistent, class 2 developmental trajectory had fairly low probabilities of physical forms of conduct problems (0.16–0.14), which means that they occasionally showed some forms of conduct problems. They had low probabilities or an absence of *truancy, destruction, and threatening other people*. These children had 0.9 ( $SD = 1.5$ ) out of 12 aggressive items endorsed by their 1st grade teacher.

In accordance with their low-aggressive developmental trajectory, class 3 children had low probabilities on all of the Conduct Problem behaviors. For each of the three trajectories, the conduct-problems endorsement profiles were similar for boys and girls.

### Trajectories and Predictors of Class Membership

All predictor variables were first entered individually to study whether they predicted class-membership and improved model fit at  $p < .05$ . Then a series of multiple regression analyses were run in which the remaining variables within the child domain were entered first, followed by variables within the parenting and contextual domain. Within the child domain, male gender, ADH problems,





**Fig. 1.** Results of the GGMM: Developmental trajectories (top) and conduct problem endorsement profiles (bottom) for early-onset/increasers, moderate-persisters and low-aggressive children.

**Table II.** Number, Gender Distribution, Mean Teacher Reported Conduct Problems and Mean Peer-Nominated Aggression for Early-Onset/Increasers, Moderate-Persisters and Low-Aggressive Children

Class	Children			TRF conduct problems	Peer nominations (max = 4)		
	N	%	Boy(%)	Baseline (max = 12)	Baseline	Follow-up after 1 year	Follow-up after 2 years
Early onset/increasers	27	9	74	5.9 (2.0) <sup>a</sup>	1.8 (0.7) <sup>a</sup>	2.2 (0.8) <sup>a</sup>	2.2 (0.8) <sup>a</sup>
Moderate-persisters	122	43	70	0.9 (1.5)	1.0 (0.5)	1.2 (0.6)	0.9 (0.7)
Normative children	139	48	30	0.2 (0.4)	0.3 (0.2)	0.3 (0.2)	0.1 (0.1)

Note. TRF = Teacher's Report Form. Standard deviations are in parentheses.

<sup>a</sup>Mean scores are different at  $p < .01$  between the classes using Bonferroni multiple comparisons.

**Table III.** Child-Behavior Predictors at Baseline of Early Onset vs. Low-Aggressive and Moderate-Persisters vs. Normative Children

Predictor variables	Means ( <i>SD</i> )			Odds ratio's (95% CI)		
	Early onset	Moderate-persisters	Low aggressive	Early onset vs. low	Early-onset vs. moderate-persisters	Moderate-persisters vs. low
<i>Child domain</i>						
Male gender	74%	70%	30%	17.8 (2.3–146)	—	6.8 (4.6–62.9)
ADH (max = 23)	13.4 (5.5)	3.4 (4.0)	0.9 (1.8)	1.4 (1.0–2.0)	—	1.2 (1.0–1.4)
Oppositional defiant (max = 8)	3.4 (1.9)	0.6 (0.9)	0.1 (0.2)	25.8 (7.6–88)	3.2 (1.3–7.9)	8.1 (3.5–18.9)
Prosocial behavior (max = 10)	1.7 (0.9)	3.3 (1.8)	4.1 (2.2)	0.3 (0.2–0.7)	0.4 (0.2–0.8)	0.8 (0.7–1.0)
<i>Parenting and contextual domain</i>						
Life events ( <i>n</i> )	1.3 (1.3)	0.4 (0.7)	0.4 (0.7)	4.5 (1.2–16.7)	—	—
Corporal punishment	5.3 (1.8)	5.4 (1.7)	4.5 (1.4)	—	—	1.4 (1.1–1.8)

Note. *SD*: Standard deviation. *CI*: Confidence interval. Odds ratio's result from multinomial logistic regression (method enter). Entries significant at  $p < .05$  are given.

oppositional defiant problems and low Prosocial behavior discriminated between early-onset/increasers and low-aggressive children and between moderate-persistent and low-aggressive children, and oppositional defiant problems and poor prosocial behavior discriminated between early-onset/increasers and moderate-persistent children (Table III). Within the parenting and contextual domain, only life-events discriminated between early-onset/increasers and low-aggressive children and harsh parental discipline discriminated between moderate persistent and low-aggressive children. The large odds ratio's and confidence intervals of male gender and oppositional defiant problems between early-onset/increasers and low-aggressive children warrant caution for the interpretation of these odds. Especially for ODD problems, this seems largely due to the fact that all but one child following the low-aggressive trajectory had a complete absence of ODD problems.

### Trajectories and Teacher Rated Problem Behavior and Peer Rejection at Outcome

Teacher reported externalizing problem behavior, poor academic functioning and peer rejection at the 2-year

follow-up were included in the model. Results are given in Table IV. Outcomes are given only for children present at the 2-year follow-up. The three developmental trajectories of aggressive behavior were associated with significantly different outcomes. Children following the early-onset trajectory had the highest levels of teacher rated Externalizing scores at outcome. To assess the clinical relevance of these problem scores, the percentages of children within each class scoring above the borderline or clinical cut-off on TRF/6–18 Externalizing were calculated. Almost all early-onset children were in the borderline or clinical range on TRF Externalizing; 67% were above the clinical cutoff, and 29% were in the borderline range on TRF Externalizing, which was similar for boys and girls. In addition to high levels of Externalizing problems, 81% were rated as having difficulty in school functioning by their 3rd grade teachers, which was again similar for boys and girls. The high levels of peer rejection substantiate the poor outcomes of early-onset children. In fact, all of these children were rated as rejected at least once during the early elementary school period. Thirty-three percent of these children were rejected during all these years, which was more frequent in boys than girls ( $\chi^2 = 4.7$ ,  $df = 1$ ,  $p < .05$ ).

**Table IV.** Mean TRF Externalizing Scores, Percentage Children in Borderline and Clinical Range of TRF, Percentage Poor Academic Performance at Outcome and Percentage Rejected Sociometric Status for 3 Trajectory Classes of Aggression

Class	TRF externalizing			Poor school performance	Rejected, %	
	Mean	Borderline (%)	Clinical (%)	%	Ever	Stable
Early-onset/increasers ( $n = 21$ )	22.4 (9.4) <sup>a</sup>	29	67	81	100	33
Moderate-persisters ( $n = 98$ )	7.0 (7.2)	12	12	30	40	4
Low aggressive ( $n = 122$ )	0.9 (1.5)	1	0	21	13	0

Note. TRF = Teacher's Report Form. Standard deviations are in parentheses.

<sup>a</sup>Means of children in all three classes are different at  $p < .01$  using the Bonferroni correction for multiple comparisons.

For moderate-persisters, mean Externalizing scores were significantly lower than those of early-onset children (Table IV). However, 24% of the moderate-persisters had scores in the borderline or clinical range on TRF Externalizing. Thirty percent of these children had difficulty in school functioning. Compared to early-onset children, significantly fewer moderate-persisters were rejected. However, 40% were ever rejected but only 4% (5 children) were consistently rejected. The percentage of children having these outcomes was similar for boys and girls. No subgroup of children with a consistent pattern of these negative outcomes was found in these moderate persistent children.

Finally, low-aggressive children were least likely to have poor outcomes. These children had very low or no teacher rated Externalizing behavior in 3rd grade, resulting in only one child in the borderline and no children in the clinical range on the TRF Externalizing scale. Twenty-one percent had a poor school performance. Although 13% of these children were rejected on one occasion, none of them were rejected at each assessment. The outcomes were similar for boys and girls.

## DISCUSSION

Developmental trajectories of peer-nominated aggression were explored in this study. By using peer nomination data, this study expands on recently published studies on the development of aggression and antisocial behavior. By directly including predictors of class-membership at baseline and outcomes in the model, and by allowing for class-specific variances of the growth factors and indicators for the low-aggressive trajectory, this study also overcame two methodological shortcomings of many of the recently published studies on developmental trajectories. Apart from the statistical support for allowing the variances in the low-aggressive behavior trajectory to be different from the total sample, this study also provided substantive support for this procedure. Children following the low-aggressive trajectory had very low levels or even an absence of risk factors, and they had a low prevalence of poor outcomes. On the basis these predictors and outcomes, the course of aggression for each of these children is expected to be constantly low, with no or only very limited variation over time.

Three classes of elementary school children with class-specific conduct problems at baseline and class-specific subsequent developmental trajectories of peer-nominated aggression were identified in this study. Only 9% of all children were in the early-onset trajectory class. The identification of a class of children of this size is in

accordance with previously reported findings on developmental pathways of antisocial behavior and aggression (Broidy et al., 2003; Moffitt et al., 1996, 2002; Nagin & Tremblay, 1999). Several poor outcomes were found for these children: All of these children were rejected at least once over the follow-up period and 33% were rejected on all three assessments. All but one of the early-onset children scored in the borderline or clinical range of the TRF Externalizing scale at outcome, with the majority in the clinical range. These percentages are approximately six times higher than those found in the general population of Dutch children (Verhulst et al., 1997). Peer rejection and early aggressive behavior have been shown to be strong predictors of early starting conduct problems (Miller-Johnson, Coie, Maumary-Gremaud, & Bierman, 2002), prolonged externalizing behavior into adolescence (Coie, Lochman, Terry, & Hyman, 1992; Coie, Terry, Lenox, Lochman, & Hyman, 1995), and extreme forms of delinquency (Miller-Johnson, Coie, Maumary-Gremoud, Lochman, & Terry, 1999).

Teachers indicated that physical forms of conduct problems characterized children who developed along the early-onset/increasers trajectory. Loeber et al. (1995) found that of all conduct disorder symptoms, physical fighting in childhood best predicted the onset of conduct disorder, and Nagin and Tremblay (1999) reported that physical aggression best predicted juvenile delinquency. Membership in this trajectory class was predicted by male gender, comorbid ADH problems, and oppositional defiant problems, and by low prosocial behavior in 1st grade. In addition to risk factors in the child domain, these children were more likely to have experienced negative life events in early childhood, like family breakup, serious health problems of the parents, a death in the family, or conviction to jail for one of the parents. Lahey et al. (1999) found that the presence of ADHD predicted an early onset of conduct disorder and Moffitt (1990) reported conduct disorder to be more persistent when it co-occurred with ADHD. Oppositional defiant problems are reported to be a developmental precursor of aggression and conduct problems (Loeber et al., 1995). Nagin and Tremblay (2001) found low-prosocial behavior to discriminate high physical aggression developmental trajectories from low-aggression trajectories. Therefore, the symptom-endorsement profile at baseline, the high comorbid ADH problems, oppositional defiant problems, and low levels of prosocial behavior and the poor outcomes all indicate that these children are at risk for various poor outcomes later in life. The developmental trajectory and the proportion of children suggest that these early onset/increasers resemble children who were called 'life course persistent' by Moffitt (1993) or 'chronic' by Nagin and Tremblay

(1999) and Broidy et al. (2003). Outcomes for these children are associated with psychopathic personality traits of alienation, impulsivity, and callousness (Moffitt et al., 1996), juvenile delinquency (Nagin & Tremblay, 1999), and a disproportionally high rate of conviction for violent crimes in adolescence and young adulthood (Jeglum-Bartusch, Lynam, Moffitt, & Silva, 1997; Moffitt et al., 1996, 2002).

Forty-two percent of the children had a 'moderate-persistent' developmental trajectory of aggression. These children were discriminated from low-aggressive children in that they did show some forms of physical aggression, although the probabilities of having these behaviors endorsed were fairly low. Their outcomes were better than for early-onset children. Twenty-four percent of 'moderate-persistent' children score in the borderline or clinical range of TRF Externalizing which is higher than the percentage found in the general population (Verhulst et al., 1997). Of importance is that no subclass of children within the class of moderate-persisters was found who accounted for these poor outcomes. Since this class contained more than 50% of all boys in this sample, following a moderate-persistent trajectory appears to be normative for boys. This finding is in line with the observation that some disruptive behavior is normative in early elementary schoolchildren (Van Lier, Verhulst, van der Ende, & Crijnen, 2003).

In line with the theories of different developmental trajectories of antisocial behavior, we identified an early-onset trajectory of high-aggressive behavior. Our findings are also in accordance with Loeber's and Stouthamer-Loeber's (1998) preschool onset pathway, since this trajectory was predicted by ADH problems. It is, however, important to notice that a second trajectory was identified with elevated and stable aggression levels throughout middle elementary school. Other studies have also found additional trajectories. For instance, a 'recovery' trajectory, characterized by high levels of antisocial behavior in childhood but not in adolescence was identified (Moffitt et al., 1996, 2002). The identification of the moderate-persister trajectory was further substantiated by Nagin and Tremblay (1999) and Broidy et al. (2003) who found additional trajectories starting early. It can be argued that the moderate-persisters trajectory resembles the second childhood-onset trajectory posited by Loeber and Stouthamer-Loeber (1998). However, the fact that ADH problems did not discriminate between early-onset/increasers and moderate-persisters is not in accordance with their theory.

The results of this study show that females are less likely to follow the early-onset or moderate trajectory of aggressive behavior. Whether they will participate in the 'delayed onset' pathway that is hypothesized by

Silverthorn and Frick (1999) cannot be tested because of the limited age-range of the current study. In line with that theory, the vast majority of girls in the present study followed the low-aggressive trajectory, which may therefore be considered normative for girls. However, a number of girls did follow the early-onset or the moderate-persistent trajectory at early elementary school and the outcomes associated with these trajectories are similar for girls as for boys. This last observation does not support Silverthorn and Frick's theory of separate antisocial pathways for males and females.

There are limitations to this study. First, peer nominations of aggression were used. The high and increasing scores of early-onset children could reflect actual levels of aggression, but may also reflect an increase in number of children that view these children as being aggressive. However, the correlations between peer and teacher reports were high and teachers rated almost all of the early-onset children as having clinically elevated externalizing behavior at outcome, which validates the findings and suggests that peer reports do represent actual behavior. Regardless of this, the fact that peers view early-onset children as increasingly deviant and exclude them from interaction with normative peers places these children at risk for affiliation with similarly deviant peers and the associated risks. Related to the use of peer nominations, developmental trajectories are generally based on information obtained from the same informants across time (e.g., parent or self-reports). The nominators for the peer-nominated aggression scores changed slightly over time as new children moved into the classrooms. New children were allowed to nominate and to be nominated but were not included as study subjects because data on all predictor variables were missing for these children. In the present study, only data for children who remained in the original school class over grades 1–3 were used. The high correlations between the repeatedly assessed peer-nominated aggression scores indicated that even with the slight changes in nominators, a high consensus about the behavior of peers existed.

Second, the developmental trajectories were based on assessments at only three time-points. This enabled us to specify only a basic growth model with intercept and a linear slope. The development of children following the early-onset trajectory will not continue to follow the linear growth path with increasing levels of aggression at older ages. Closer examination of the observed rather than the estimated development of children of the chronic physical aggression group identified by Nagin and Tremblay (1999) showed that children following this path had an increasing level of aggression in early childhood which was followed by a decrease later in adolescence resulting

in a persistently high-aggression group. This may imply that a similar shaped trajectory can be found in the current sample once the follow-up period is extended into adolescence.

Third, children were approximately 7-years-old at baseline and were followed for 2 years. Although the developmental trajectories and outcomes of children with the early-onset developmental trajectory indicate that these children are at risk, these children still have to enter adolescence when the expected poor outcomes become apparent. It is important to notice in this regard that some of the early-onset children may move on to follow the recovery path as described by Moffitt et al. (1996, 2002). The predictive power of the identified trajectories is therefore limited to a poor developmental outcome of aggressive behavior across childhood only.

Fourth, only two risk factors from the parenting/contextual domain discriminated between the three trajectory classes. The trajectory classes were based on the course of children's behavior in the school. The risk factors in the child domain were collected within the school context, whereas the risk factors in the parenting/contextual domain were collected in the home context. The factors within the child context may therefore be linked more closely to these trajectories than factors within the parenting or contextual domain. The importance of risk factors from the parenting and contextual domains may therefore be underestimated.

The findings have implications for our understanding of the development of aggression, for preventive programs targeting aggression in young children, and for clinical practice. The developmental trajectories identified in this study were based on peer nominations of aggression. Previous studies on developmental trajectories were based on parent, teacher, and self-report data. In accordance with those studies, an early-onset trajectory was also identified in these peer-nominated aggression data. Of importance is, as Coie and Jacobs (1993) described, that the influence of the child's broader social context, which refers to the interaction with classmates and peers, plays a crucial role in the emergence, the manifestation, and the maintenance of aggressive behavior. Since peer nominations of aggression are not only a measure of the behavior of children but also a reflection of the social context in which children operate, the results of this study have implications that go beyond the previous reported studies on developmental trajectories. Three findings from this study are of importance. First, significant differences between the trajectories in levels of aggression were already found in 1st grade, which indicates that peers are well aware of aggressive behavior in classmates as early as entry at elementary school. Second, children with poor outcomes

all showed pronounced (early onset) or mild (moderate-persisters) levels of physical aggression in 1st grade. This suggests that their peers respond especially to these forms of overt aggression, in addition to ADHD problems, oppositional defiant problems, and poor prosocial behavior. Third, peers increasingly regard children following the early-onset developmental trajectory as being aggressive. Therefore, the trajectory itself, the high percentage with rejected status, and the related poor outcomes indicate that when children enter elementary school with a behavioral pattern of coercion and physical aggression, they will experience the social consequences of their behavior. Classmates develop high levels of nonacceptance and mistrust and will retaliate by rejecting early aggressive children. Early-onset children have, and continue to develop social problems with their nonaggressive classmates, and they increasingly deviate from the normative social peer group, which enhances their risk for affiliation with similarly deviant peers. Patterson, Dishion, and Yoerger (2000) showed that the affiliation with deviant peers predicted continued high levels of aggression, resulting in delinquency and police arrests in adolescence.

These results also have implications for prevention programs and clinical practice. First, preventive programs should primarily focus on the early prevention of physical aggression but should differ in: (1) the intensity in which they target the physical aggression, and (2) whether they also target covert and relational forms of aggressive behavior and prosocial behavior. Children in the early-onset trajectory are in need of intensive programs targeting all types of conduct and ADHD problems and their lack of prosocial behavior. Children in the moderate-persisters pathway may also be considered for intervention, but these interventions should target physical aggression only, not covert forms of conduct problems, and the ADHD problems. Second, the trajectory of early-onset children shows that these children experience the social consequence of their aggressive behavior. Preventive as well as clinical programs should therefore try to actively divert the developmental process by (1) making aggressive young children aware of their social status, (2) trying to break the cycle of emphasis on negative behavior, which is characteristic for these aggressive children (Coie & Jacobs, 1993; Patterson et al., 1992), and (3) making young aggressive children aware of the consequences of their behavior.

The importance of physical aggression as a marker of the development of high and increasing levels of aggressive behavior suggests that screening programs should focus on these overt forms of aggression. However, clear *markers* for identifying children following the early-onset trajectory were not identified although various forms of physical aggression marked children from the early-onset

trajectory. Clear *markers* for following an early-onset trajectory would have been expressions of conduct problems occurring in almost all early-onset children and absent in almost all of the children following the other two trajectories. The probabilities of physical aggression were much lower but not absent for moderate-persisters. The subsequent developmental trajectory and outcomes, however, suggest that moderate-persisters are at much lower risk for the negative outcomes associated with conduct problems than children following the early-onset developmental trajectory. Physical aggression in early childhood can therefore be considered a pronounced risk factor for following a high-risk developmental trajectory. However, physical aggression cannot be regarded as a behavior that characterizes only children who follow an early-onset trajectory of aggression.

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